83769

S/056/60/039/003/024/045
B006/B063

9.4300 (1035, 1138, 1143)

AUTHORS: Buishvili, L. L., Khutsishvili, G. R., Cheyshvili, O. D.

TITLE: Magnetic Relaxation in Ferromagnetic Metals

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 3(9), pp. 726-736

TEXT: In the present paper, the authors calculate the magnetic relaxation in ferromagnetics due to s-d-exchange interaction. They use a simplified model of the ferromagnetic metal, which is based on the assumption of two groups of electrons (conduction electrons and ferromagnetic electrons). The relaxation terms are determined in microscopic spin-wave approximation. The authors confine themselves to the simplest case of a cubic crystal (Fe, Ni), and $\vec{H}$ (parallel to the z-axis) is assumed to be so large that the sample may be regarded as a single-domain crystal. First, the authors derive expressions for H_s and H_d, which are the magnetic fields (due to s-d interaction) acting upon the spin of the conduction electron and that of the ferromagnetic ion, respectively. For $V = -A\vec{S}\vec{S}_d$ one obtains $H_s = AS_d/g_s\beta$ and $H_d = (3g_sAQ/8g_d\mu_0)H$. Proceeding from the spin

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Hamiltonian of the conduction electron, the authors then derive the second quantization Hamiltonian as well as expressions for the energy spectrum of the conduction electron and for the energy of the ferromagnon. By use of the perturbation theory the authors study the variation of the ferromagnon distribution function n(f) in time. The double absolute value of the sum of projections of all d-spins is expressed by L, and L_o gives the equilibrium value of L. dL/dt and $\Delta n(f)$ are obtained with $L_o - L = 2\sum_f \Delta n(f)$ and $|L_o - L|/L_o \ll 1$. The fact that the spins of the conduction electrons and the ferromagnetic spins interact not only with each other but also directly with the lattice is taken into account in the following. A number of special cases are calculated. The relaxation times T_{sd} and T_{ds}, which are defined by formula (29), are finally estimated for iron by means of the experimental value of the number of magnetons per iron atom (2.22). Thus, one obtains

$\frac{1}{T_{sd}} = 2\cdot 10^9 T \ln \frac{T}{0.8+1.3\cdot 10^{-4}H}$; $\frac{1}{T_{ds}} = 10^9\sqrt{T}$; these relations hold for

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temperatures from 2 - 3°K to about 100°K. The following relation is found for the relaxation time of interaction between the spin of the conduction electrons and the lattice T_{sl}: $T_{sl} \sim 10^{-11}/(\Delta g)^2 T$. The authors thank M. I. Kaganov and V. G. Bar'yakhtar for discussions. A. I. Akhiyezer, I. Ya. Pomeranchuk, S. V. Peletminskiy, and Ye. A. Turov are mentioned. There are 18 references: 8 Soviet, 8 US, 1 Japanese, and 1 French.

ASSOCIATION: Institut fiziki Akademii nauk Gruzinskoy SSR (Institute of Physics of the Academy of Sciences Gruzinskaya SSR)

SUBMITTED: April 7, 1960

APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000307320016-9"

S/181/60/002/009/045/047/XX
B004/B070

24.2200

AUTHOR: Buishvili, L. L.

TITLE: Overhauser Effect in Metals With Paramagnetic Impurities

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 9, pp. 2268-2269

TEXT: A study is made of the polarization of the nuclei of paramagnetic ions in metals containing paramagnetic impurities. The results are applicable also to alloys one of whose components is a non-transition and the other a transition metal (Cu - Mn). The spin Hamiltonian of the system conduction electron - paramagnetic ion is written as $\mathcal{H}=g_1\beta H_oS_z +g\beta H_os_z - \hbar\gamma_nH_oI_z + A_o(SI) + A(sI) + B(Ss)$ (1), where s is the spin of the conduction electron, S the effective spin of the electron shell of the paramagnetic ion, I its nuclear spin, A_o and A the constants of the hyperfine structure, and B the constant of interaction of the electron spin with the shell of the paramagnetic ion. Assumption is made of the saturation of the resonance of the conduction electrons, and the spin

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effect is neglected. Thus, the results are valid only for small samples. Values proportional to the probability of transition are given in a table. The degree of saturation is denoted by σ. The following results hold: $\lambda_1 \sim (A/B)^2$; $\lambda_2, \lambda_2' \sim (A_0/g\beta H_0)^2$; $\Delta = g\beta H_0/4kT$; $\Delta_1 = g_1\beta H_0/4kT$, and $\alpha = g_1/g$:

	a	a'	b	b'
a	—	$\exp[-\Delta(\alpha-\sigma)]$	$(\lambda_1+\lambda_2)\exp(-\Delta\sigma)$	$2\lambda_2'\exp(-\Delta_1)$
a'	$\exp[\Delta(\alpha-\sigma)]$	—	—	$(\lambda_1+\lambda_2)\exp(-\Delta\sigma)$
b	$(\lambda_1+\lambda_2)\exp\Delta\sigma$	—	—	$\exp[-\Delta(\alpha-\sigma)]$
b'	$2\lambda_2'\exp(\Delta_1)$	$(\lambda_1+\lambda_2)\exp(\Delta\sigma)$	$\exp[\Delta(\alpha-\sigma)]$	—

The following is obtained for the polarization of the nucleus in the steady state: $f_1 = \frac{(\lambda_1+\lambda_2)\,\mathrm{sh}\,\Delta\sigma + \lambda_2'\left[\mathrm{sh}\Delta_1 - \mathrm{th}\Delta(\alpha-\sigma)\mathrm{ch}\Delta_1\right]}{(\lambda_1+\lambda_2)\,\mathrm{ch}\,\Delta\sigma + \lambda_2'\left[\mathrm{ch}\Delta_1 - \mathrm{th}\Delta(\alpha-\sigma)\mathrm{sh}\Delta_1\right]}$ (3). The limiting case $\lambda_1 \gg \lambda_2, \lambda_2'$ of (3) yields the known equation of the Overhauser

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Overhauser Effect in Metals With Paramagnetic Impurities

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effect in pure metals. G. R. Khutsishvili is thanked for guiding the work. There are 1 table and 2 non-Soviet references.

ASSOCIATION: Institut fiziki AN GruzSSR (Institute of Physics of the AS of the Gruzinskaya SSR)

SUBMITTED: March 15, 1960

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BUISHVILI, L.L.; KHUTSISHVILI, G.R.; CHEYSHVILI, O.D.

Magnetic relaxation in ferromagnetic metals. Zhur. eksp. i teor. fiz. 39 no.3:726-736 S '60. (MIRA 13:10)

1. Institut fiziki Akademii nauk Gruzinskoy SSR.
(Ferromagnetism)

BUISHVILI, L.L.

Nuclear relaxation caused by local electron centers. Fiz. tver. tela 3 no.8:2451-2454 Ag '61. (MIRA 14:8)

1. Institut fiziki AN Gruzinskoy SSR.
(Nuclear magnetic resonance and relaxation)

30779

S/181/61/003/011/013/056
B102/B138

24.7800 (1043,1145,1153)

AUTHOR: Buishvili, L. L.

TITLE: Nuclear quadrupole relaxation in ferrodielectrics

PERIODICAL: Fizika tverdogo tela, v. 3, no. 11, 1961, 3336-3338

TEXT: The hyperfine interaction between nuclear spin and electron shell spin is studied in order to investigate the relaxation mechanism in a ferrodielectric. If external magnetic field and easiest magnetization are in different directions, spin interaction will be described not only by single but also by two-magnon terms. The latter predominate at not too low temperatures (single-magnon processes only prevail in relaxation for $kT \lesssim 0.1^{\circ}K$). An expression is derived for the transition probability in two-magnon processes:

$$W(m \pm \sigma, m) \simeq \frac{A^2 (k_B T)^2}{4 Q_C^3 (2\pi)^3 \hbar} \left| \mp (m \pm \sigma) \left(\frac{2B^{\pm}_{\sigma m}}{\sigma A} \right) \pm m \left(\frac{2B^{\mp}_{\sigma, m \pm \sigma}}{\sigma A} \right)^{*} \right|^2 ,$$

X

which holds in spin-wave approximation for temperatures $k_B T > g\mu_B H_1$; Q_C is

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Curie temperature A the hyperfine interaction constant, and

$$\overline{B_{2m}^{\pm}} = B[(I \mp m)(I \mp m - 1)(I \pm m + 1)(I \pm m + 2)]^{1/2} V_{\mp 2},$$

$$V_{\pm 1} = V_{xz} \pm iV_{yz}, \quad B = \frac{eQ}{4I(2I+1)},$$

$$V_{\pm 2} = \frac{1}{2}(V_{xx} - V_{yy}) \pm iV_{xy}, \quad V_{jk} = \frac{\partial^2 V}{\partial x_j \partial x_k},$$

where Q is the nuclear quadrupole moment, V the innercrystalline electric potential, I the nuclear spin and z the direction of easiest magnetization. A comparison between transition probabilities due to hyperfine interaction with the result obtained show that quadrupole relaxation will be more effective if

$$\left| \mp (m \pm \sigma) \left(\frac{2B_{\sigma m}^{\pm}}{\sigma A} \right) \pm m \left(\frac{2B_{\sigma, m \pm \sigma}^{\mp}}{\sigma A} \right)^{*} \right|^2 > \varphi^2,$$

where φ is the angle between the axis of nuclear spin quantization and electron shell spin. For a spinel-type ferrite at 80°K the probability is

32087
S/181/61/003/012/022/028
B108/B138

24.2200 (1144, 1158)

AUTHOR: Buishvili, L. L.

TITLE: Spin-lattice relaxation in ferrites with paramagnetic impurities

PERIODICAL: Fizika tverdogo tela, v. 3, no. 12, 1961, 3706-3711

TEXT: The author calculated the spin-lattice relaxation time for paramagnetic impurities in ferrites with the aim of demonstrating that below about 200°K it is interaction with the magnetic moment of the ferromagnetic which is predominant. Interaction between the electrons of the impurity is neglected. In the Holstein-Primakoff formalism, one-, two-, and three-magnon terms appear. It is shown that the one-magnon process has the shortest relaxation time (10^{-11} - 10^{-12} sec), which means that exchange interaction plays a very important part below room temperature. The relaxation time of direct spin-lattice interaction is about 10^{-12} - 10^{-13} sec at room temperature, and it increases as the

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S/181/61/003/012/022/028
Spin-lattice relaxation in ferrites ... B108/B138

temperature falls. When free carriers are present (metal impurities) $T_{sd} \simeq 10^{-7} - 10^{-8}$ sec. The relaxation time of direct interaction between electron and lattice is of the same order of magnitude. In the temperature range considered, the Overhauser effect (A. Overhauser. Phys. Rev., 92, 411, 1953) is also normal at free-electron spin saturation, because of the strong splitting of the spin levels of the free electrons. There are 8 references: 3 Soviet and 5 non-Soviet. The four most recent references to English-language publications read as follows: C. Kittel. J. Appl. Phys. Suppl., 31, 11S, 1960; Phys Rev., 115, 1687, 1959; P.G.Gennes et al. Phys. Rev., 116, 323, 1959; A. Mitchell. J. Chem. Phys., 27, 17, 1959; R. Elliot. Phys. Rev., 96, 266, 1954.

ASSOCIATION: Institut kibernetiki AN Gruz. SSR, Tbilisi (Institute of Kybernetics AS Gruzinskaya SSR, Tbilisi)

SUBMITTED: July 10, 1961

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BUISHVILI, L.L.; KHUTSISHVILI, G.R.

Overhauser effect in a low magnetic field. Trudy Inst.fiz.AN Gruz.SSR 8:203-207 '62. (MIRA 16:2)
(Paramagnetic resonance and relaxation)
(Magnetic fields)

3425

S/181/62/004/002/046/051
B102/B138

24.7900 (1055, 1144, 1147, 1163)

AUTHOR: Buishvili, L. L.

TITLE: Combined resonance in crossed electric and magnetic fields

PERIODICAL: Fizika tverdogo tela, v. 4, no. 2, 1962, 558 - 560

TEXT: E. I. Rashba (FTT, 2, 1224, 1960) first discovered the so-called combined resonance of the band electrons caused by electrical or magnetic vectors of a h-f field, which is accompanied by a change in the spin and orbital state of the electrons. This resonance was investigated on the assumption of an external constant electric field, $\vec{E} \parallel y$, and constant magnetic field $\vec{H} \parallel z$. $\vec{H}$ should be strong enough for the distances between the Zeeman and the Landau levels to be much larger than the spin-orbit interaction energy. For a vector potential $A_x = -Hy$, $A_y = A_z = 0$, the wave function in effective-mass approximation, neglecting spin-orbit interaction, reads $\Psi^0_{n\sigma} = f_n(x,z,y-Y)\chi(\sigma)$ (n - quantum number for Landau levels, σ - spin quantum number, $Y = \frac{P_x}{m\omega} + \frac{eE}{m\omega^2}$; ω - cyclotron resonance

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Combined resonance in... S/181/62/004/002/046/051
B102/B138

frequency. Spin-orbit interaction is considered as a perturbation

$$H' = \frac{\hbar e}{4m^2c^2}\left(\sigma\left[\nabla(yE),\ \mathbf{p} - \frac{e}{c}\mathbf{A}\right]\right). \qquad (2)$$

So in first perturbation-theoretical approximation

$$\Psi_{n,\pm 1/2} = \Psi^0_{n,\pm 1/2} \mp \lambda \frac{p_z}{\hbar\omega_s} \Psi^0_{n,\pm 1/2} \pm \lambda \sqrt{\frac{2m(n+1)}{\hbar\omega}}\, \Psi^0_{n+1,\mp 1/2} \mp$$
$$\mp \lambda \sqrt{\frac{2mn}{\hbar\omega}}\, \Psi^0_{n-1,\mp 1/2}; \qquad (3)$$
$$\lambda = \frac{eE\hbar}{8m^2c^2};$$

X

where ω_s is the paramagnetic resonance frequency. For transitions caused by a variable field $H \parallel z$, $\Delta n = 0$, $\Delta\sigma = \pm 1$, the probability

$$\frac{W}{W_0} = \frac{e^2 kT}{16 m^3 c^4 \omega_s^2} E^2; \qquad (5)$$

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is obtained; $\overline{p_z^2}/2m = kT/2$, W_o - probability of ordinary paramagnetic resonance. If the variable H-field is perpendicular to z, besides the ordinary paramagnetic resonance combined resonance may occur with the selection rules

$$\left.\begin{array}{ll} \Delta n = \pm 1, & \Delta\sigma = \pm 1. \\ \Delta n = \pm 1, & \Delta\sigma = \mp 1. \end{array}\right\} \quad (6)$$

and the probabilities

$$\frac{W}{W_0} = \frac{c^2 \hbar E^2}{8 m^3 c^4 \omega} \times \left\{ \begin{array}{lll} n+1 & \text{при} & n \to n+1, \\ n & \text{при} & n \to n-1. \end{array}\right. \quad (7).$$

$\omega + \omega_s$ and $\omega - \omega_s$ are the transition frequencies. For $T \sim 10^{o}K$ $\omega \sim 10^{11} sec^{-1}$ and $E \sim 10^5$ v/cm, $W/W_o \sim 10^{-2}-10^{-3}$. G. R. Khutsishvili, M. Ya. Azbel' and E. I. Rashba are thanked for their interest. There are 5 references: 4 Soviet and 1 non-Soviet. The reference to the English-language publication reads as follows: E. N. Adams a. F. D. Holstein. Phys. and

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S/181/62/004/002/046/051
B102/B138

Combined resonance in...

Chem. of Sol., 10, 254, 1959.

ASSOCIATION: Institut kibernetiki AN Gruz. SSR Tbilisi (Institute of Cybernetics AS Gruzinskaya SSR, Tbilisi)

SUBMITTED: November 9, 1961

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Card 4/4

24.2200

37947

S/181/62/004/005/046/055
B164/B102

AUTHOR: Buishvili, L. L.

TITLE: Acoustic nuclear paramagnetic resonance in ferromagnetics

PERIODICAL: Fizika tverdogo tela, v. 4, no. 5, 1962, 1367

TEXT: As the varying magnetic field created by the thermal motion of nuclei in the non-uniform magnetic field of a domain wall leads to transitions between nuclear spin levels, ultrasonic resonance absorption is assumed to be of about the same strength as that obtained with varying electromagnetic fields. The author considers a simple case with 180° boundaries and spin-1/2 nuclei. By substituting the appropriate value of the relaxation time for single-phonon processes in the ultrasonic absorption σ coefficient one obtains

$\sigma = \frac{3\pi^5\hbar^2 N v^2 \omega_0^2}{4\delta^2\omega^3_{max} m_0 kT} g(\omega)$, where N is the number of nuclear spins per unit volume, v is the velocity of sound, δ is the thickness of the domain wall,

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m_0 is the nuclear mass, ω_0 is the nuclear resonance frequency, ω_{max} is the Debye frequency, and $g(\omega)$ is the function of the absorption line shape. The value of σ, estimated at $\sim(10^{-14}-10^{-15})\omega_0^2$ cm^{-1}, is five orders of magnitude higher than that obtained for KBr at the same frequency. When sound waves travel perpendicular to the domain wall, only longitudinal phonons are absorbed, and when they travel along it only transverse phonons. Owing to the different propagation velocities, the absorption coefficient also differs in the two cases. In this way, information on the domain structure of ferromagnetics be obtained from data on ultrasonic absorption. [Abstracter's note: Essentially complete translation.]

ASSOCIATION: Institut kibernetiki AN Gruzinskoy SSR, Tbilisi (Institute of Cybernetics of the AS Gruzinskaya SSR, Tbilisi)

SUBMITTED: January 24, 1962

34646
S/056/62/042/002/030/055
B108/B104

24,2200 (1144, 1158)

AUTHORS: Buishvili, L. L., Giorgadze, N. P.

TITLE: Spin-lattice relaxation of nuclei during nuclear resonance in ferromagnetics

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 2, 1962, 499 - 502

TEXT: Portis and Gossard (Ref. 1, see below) have concluded from their measurements that nuclear magnetic resonance is determined essentially by the nuclei in the domain walls which are subjected to an internal inhomogeneous magnetic field. The thermal vibrations of the nuclei produce an alternating magnetic field which causes transitions between the nuclear levels. The energy of a perturbation induced by an internal magnetic field H_x is determined by the relation

$$H' = \pi \frac{\hbar\omega_0}{2\delta}(I^+ + I^-)\sum_k (a_k e^{ikr} + a_k^+ e^{-ikr}), \qquad (5)$$

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S/056/62/042/002/030/055
B108/B104

Spin-lattice relaxation of...

where $\omega_0 = \gamma H_n$ is the nuclear resonance frequency, $I^{\pm} = I_x \pm iI_y$. δ is the domain wall thickness. The transition probability is then

$$W_{m,m-1} \approx (I+m)(I-m+1)(3\pi^3\hbar/4\delta^2 m_0)(\omega_0/\omega_m)^3(e^{\hbar\omega_0/\theta}-1)^{-1}, \quad (6)$$

where ω_m is the maximum Debye frequency, θ - temperature (in energy units), m_0 - mass of nucleus. The effective relaxation time T_1 can be determined from the mean polarization $\langle S_1\rangle$ in the boundary layer: $\langle S_1\rangle = S_0/(1 + wT_1)$ where w is the transition frequency in the r.f. field. The equilibrium polarization S_0 of the nuclear spin is found from the diffusion equations for the wall and for inside the domain. Finally

$$T_1 \cong (3\pi^2/2)^{1/2}(\tau_1^4 T_2/\tau_1^3)^{1/2}$$

where T_2 is the spin-spin relaxation time, τ_1 is the relaxation time related

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S/056/62/042/002/030/055
B108/B104

Spin-lattice relaxation of...

to direct interaction with the lattice. It is found that T_1 is proportional to $\theta^{-1/2}$. The results of this calculation agree well with the experimental data. G. P. Khutsishvili (UFN, 71, 9, 1960) is mentioned. There are 6 references: 2 Soviet and 4 non-Soviet. The references to the English-language publications read as follows: A. M. Portis, A. C. Gossard. J. Appl. Phys., 31, 205S, 1960; Phys. Rev. Lett., 3, 164, 1959; J. H. Van Vleck. Phys. Rev., 57, 426, 1940.

ASSOCIATION: Institut fiziki Akademii nauk Gruzinskoy SSR (Institute of Physics of the Academy of Sciences of the Gruzinskaya SSR). Institut kibernetiki Akademii nauk Gruzinskoy SSR (Institute of Cybernetics of the Academy of Sciences of the Gruzinskaya SSR)

SUBMITTED: August 3, 1961

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44509

S/181/63/005/001/035/064
B108/B180

AUTHOR: Buishvili, L. L.

TITLE: The nuclear spin-lattice relaxation in ferro- and antiferromagnetics

PERIODICAL: Fizika tverdogo tela, v. 5, no. 1, 1963, 229 - 232

TEXT: The spin-lattice relaxation associated with dipole-dipole interaction is studied. When the inversion of the spin of a non-magnetic atom in a ferromagnetic is accompanied by the emission of a phonon and absorption of a magnon, or vice versa, the relaxation time for a spin-1/2 nucleus is

$$\frac{1}{T_1} = \frac{27hSZ(k_B T)^{9/2} I(\gamma)}{\pi M_0 a^2 \theta_C \theta_D^{9/2}},$$

$$I(\gamma) = \int_0^{\gamma} \frac{x^{9/2} e^x dx}{(e^x - 1)^2}; \quad \gamma = \min\frac{[\theta_D, \theta_C]}{k_B T}; \quad I(\gamma) = \begin{cases} \frac{3}{2}\pi^{1/2}, & \gamma \gg 1 \\ \frac{1}{2}\gamma^{1/2}, & \gamma \ll 1 \end{cases}$$

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The nuclear spin-lattice... S/181/63/005/001/035/064
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For simplicity, the Zeeman nuclear energy was omitted in the Hamiltonian expressed in terms of the production and annihilation operators. S is the electron spin, Z the number of nearest spins, M_0 the mass of the nucleus and a the lattice constant. Estimates show that for $\Theta_D \ll \Theta_C$ and $T \ll \Theta_C$ the two-magnon relaxation time is greater and for $\Theta_D > \Theta_C \gg T$ less, than that of magnon-phonon processes. The relaxation considered here only obtains in ferrodielectrics. For a non-magnetic atom in an antiferromagnetic the relaxation time for phonon-magnon processes is

$$\frac{1}{T_1} = \frac{4 \cdot 3^{1/2}}{\pi} \frac{\hbar S (S+1)^2 Z}{M_0 \theta_N^2 a^2} [|b_1|^2 + |b_2|^2] \left(\frac{k_B T}{\theta_D}\right)^2 I(\alpha, \gamma);$$

$$\gamma = \min \frac{[\theta_N, \theta_D]}{k_B T}; \quad \alpha = \frac{\theta_A}{k_B T};$$

$$\theta_A = \theta_N (2H_A)^{1/2}; \quad I(\alpha, \gamma) = \int_\alpha^\gamma \frac{(x^2 - \alpha^2)^{1/2} x e^x dx}{(e^x - 1)^2};$$

$$I(\alpha, \gamma) = \begin{cases} \frac{\pi^2}{3} & \alpha \gg 1, \ \gamma \gg 1; \\ \alpha^{3/2} e^{-\alpha} & \alpha \ll 1, \ \gamma \gg 1; \\ \gamma. & \alpha < \gamma \ll 1. \end{cases}$$

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where Θ_N is the Neel temperature. Due to electron shell overlapping there is in some cases contact interaction between the nuclear spin of a non-magnetic atom and the electron shell spin of a magnetic one. In this case, the factor $\frac{9}{a^2}(|b_1|^2 + |b_2|^2)$ in the above formula must be replaced by $|A|^2/2l^2$, where A is the constant of hyperfine interaction, and l is the radius of the electron shell. Estimates for MnF_2 ($T_1 \simeq 40$ sec at $T = 4.2^oK$) agree in order of magnitude with experimental data (20 sec; V. Jaccarino, R. G. Shylman. Phys. Rev., 107, 1196, 1957).

SUBMITTED: August 4, 1962

S/181/63/005/004/007/047
B102/B186

AUTHOR: Buishvili, L. L.

TITLE: Excitation of ultrasonic vibrations of the Bloch walls and the acoustical nuclear paramagnetic resonance in ferromagnetics

PERIODICAL: Fizika tverdogo tela, v. 5, no. 4, 1963, 1027 - 1030

TEXT: The excitation of ultrasonic vibrations of the Bloch walls of uniaxial cubic crystals is considered on the basis of Winter's calculations (Phys. Rev., 124, 452, 1961) and the ultrasound absorption coefficient σ is calculated for the case of acoustic nuclear paramagnetic resonance in ferromagnetics when magnetostriction is taken into account. The result obtained for σ is compared with that obtained previously (FTT, 4, 1367, 1962) when ultrasonic resonance absorption due to the spin-lattice relaxation mechanism was investigated. With reasonable parameters substituted into the relations it is shown that both values obtained for σ agree in their orders of magnitude and amount to $\simeq 10\ cm^{-1}$. When special materials are considered of course the one mechanism might exceed the other.

SUBMITTED: October 19, 1962

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L 14293-63 EWT(1)/EWT(m)/BDS/EEC(b)-2 AFFTC/ASD PI-4 GG

ACCESSION NR: AP3001273

S/0181/63/005/006/1574/1576

AUTHOR: Buishvili, L. L.

TITLE: Nuclear spin-lattice relaxation caused by local electron centers

19 61 60 21

SOURCE: Fizika tverdogo tela, v. 5, no. 6, 1963, 1574-1576

TOPIC TAGS: spin-lattice relaxation, electron center, diffusion coefficient, diffusion barrier, spin diffusion, paramagnetic impurities

ABSTRACT: The author found it necessary to consider the diffusion barrier when determining the spin-lattice relaxation of a nucleus caused by local electron centers (color center, acceptor, donor). Because of the slowness of the spin-lattice relaxation at many local electron centers, the author set himself the task of solving the equation of diffusion with proper consideration of the diffusion barrier, when hyperfine instead of dipole-dipole interaction occurs. In solving this equation, it is found that the relaxation time depends exponentially on the width of the diffusion barrier, the time becoming greater the greater the barrier. The barrier retards relaxation. "The author expresses his thanks to G. R. Khutsishvili for his interest in the work." Orig. art. has: 10 formulas.

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L 18025-63 EPF(c)/EWT(1)/BDS/EEC(b)-2/ES(s)-2 AFFTC/ASD/ESD-3/
SSD/IJP(C) Pr-4/Pt-4/Pi-4 GG

ACCESSION NR: AP3003874 S/0181/63/005/007/1814/1821

AUTHORS: Buishvili, L. L.; Giorgadze, N. P. 78

TITLE: Nuclear magnetic resonance in ferromagnetic materials 76

SOURCE: Fizika tverdogo tela, v. 5, no. 7, 1963, 1814-1821

TOPIC TAGS: amplification factor, nuclear magnetic resonance, ferromagnetic, transition band, resonance frequency, resonance absorption, domain, magnetostriction, hexagonal structure, cubic structure, Bloch wall, Néel wall, boundary layer

ABSTRACT: From investigation of many papers on related subjects, the authors feel that a determination of the average amplification factor in the case of an arbitrary boundary should be considered not only as a qualitative refinement of determinations in hexagonal crystals but also as a fundamental necessity. This is especially so if one keeps in mind nuclear magnetic resonance in an external steady magnetic field. They find that in a hexagonal crystal a steady magnetic field normal to a Bloch wall has no effect on the nature of resonance absorption. It is easy to determine experimentally the orientation of the boundary layer and to arrange it normal to the external field. The characteristic dependence of the amplification factor on the magnetic field in the case of a Néel wall allows the

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ACCESSION NR: AP3003874

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establishment of a relationship between the transition layer and any other type. It is found that the amplification factor depends on the direction of the magnetic field. This is related to the fact that in the absence of a field the magnetization in the boundary layer may be turned in either clockwise or counterclockwise direction. The external magnetic field deflects the magnetization in the domain from the axis of anisotropy, and, consequently, the angle of rotation becomes less than π if the projection of the magnetization on the direction of the field is positive, greater than π in the opposite case. Orig. art. has: 34 formulas.

ASSOCIATION: Institut kibernetiki AN Gruz. SSR(Institute of Cybernetics, Academy of Sciences, Georgian SSR); Institut fiziki AN Gruz. SSR, Tbilisi (Institute of Physics, Academy of Sciences, Georgian SSR)

SUBMITTED: 29Jan63 DATE ACQ: 15Aug63 ENCL: 00

SUB CODE: PH NO REF SOV: 005 OTHER: 009

Card 2/2

ACCESSION NR: AT3012966 S/2749/62/008/000/0203/0207

AUTHOR: Buishvili, L. L.; Khutsishvili, G. R.

TITLE: Overhauser effect in a weak magnetic field

SOURCE: AN GruzSSR. Institut fiziki. Trudy*, v. 8, 1962, 203-207

TOPIC TAGS: Overhauser effect, fine structure, hyperfine structure, aligned nuclei, paramagnetic salt, paramagnetic atoms with spin, oriented nuclei, orientation parameters

ABSTRACT: The case of a paramagnetic salt is considered whose paramagnetic atoms have spins. In this case the Overhauser effect can apply to the fine structure splitting or to the splitting due to the anisotropic hyperfine splitting. Expressions are derived for the nuclear orientation parameters f_1 and f_2 when one of the components of the fine or hyperfine structure is saturated by the weak magnetic field. Orig. art. has: 2 figures and 14 formulas.

ASSOCIATION: Institut fiziki AN GruzSSR (Physics Institute, AN

~~Card 1/2~~

BUISHVILI, L.L.

Nuclear spin-lattice relaxation caused by local electron centers. Fiz. tver. tela 5 no.6:1574-1578 Je '63. (MIRA 16:7)

1. Institut kibernetiki AN Gruzinskiy SSR, Tbilisi.

ACCESSION NR: AP4011745 S/0181/64/006/001/0108/0112

AUTHOR: Buishvili, L. L.

TITLE: Nuclear polarization by hot electrons

SOURCE: Fizika tverdogo tela, v. 6, no. 1, 1964, 108-112

TOPIC TAGS: polarization, nuclear polarization, electron, hot electron, spin lattice relaxation, conduction electron, impurity electron, exchange interaction, free electron

ABSTRACT: The author starts from the assumption of a sample with nuclear spins and free electrons and with the assumption that relaxation of the nucleus is determined by conduction electrons. Then, he assumes further that the spins of the impurities and free electrons, in interacting among themselves, are insulated from the lattice. The exchange interaction between impurity spins and the spins of conduction electrons is dominant, and, as a result, impurity electrons and conduction electrons change places. In considering the spin-lattice relaxation of conduction electrons, the author examines two cases: relaxation with participation of nonmagnetic impurities and relaxation with the participation of phonons. He

ACCESSION NR: AP4011745

obtains the expression

$$\beta_s \simeq \beta_d \simeq \beta_l \Big/ \left(1 + \frac{\tau_{dl} n}{\tau_{sk} N}\right),$$

where β_s is the reciprocal value of the electron Zeeman temperature, β_d the reciprocal value of impurity spin temperature, β_l the reciprocal value of lattice temperature, τ_{dl} the time of spin-lattice relaxation of impurity electrons, τ_{sk} the time of spin-lattice relaxation of conduction electrons, n the number of free electrons, and N the number of donors.

$$\frac{\tau_{dl} n}{\tau_{sk} N} \simeq 1-100,$$

which means that the spin temperature of impurity and free electrons increases twice as much as the lattice temperature when $n \simeq 10^{-8}$ cm^{-3}. And this is in agreement with experiment. In view of the low concentration of free electrons, polarization will not take place in the principal nuclei but in the nuclei of the impurities. "The author expresses his thanks to G. R. Khutsishvili for proposing

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ACCESSION NR: AP4011745

the problem and discussing the results and to G. Ye. Gurgenishvili for suggestions and discussions of the results." Orig. art. has: 21 formulas.

ASSOCIATION: Institut kibernetiki AN Gruz SSR, Tbilisi (Institute of Cybernetics AN Gruz SSR)

SUBMITTED: 10Jul63 DATE ACQ: 14Feb64 ENCL: 00

SUB CODE: PH NO REF SOV: 001 OTHER: 007

Card 3/3

ACCESSION NR: AP4019857 S/0181/64/006/003/0903/0905

AUTHOR: Buishvili, L. L.

TITLE: Theory of nuclear magnetic resonance in ferromagnetic dielectrics

SOURCE: Fizika tverdogo tela, v. 6, no. 3, 1964, 903-905

TOPIC TAGS: nuclear magnetic resonance, ferromagnetic dielectric, retarded Green's function, demagnetization, hyperfine interaction

ABSTRACT: Computation of the frequency and intensity of nuclear magnetic resonance (NMR) for a single-domain ferromagnetic dielectric is carried out, using the method of retarded Green's functions. The microscopic theory of NMR is considered, taking into account the demagnetizing field and the simultaneous action of the variable external field on the nuclear spin (both directly and through the magnetic electrons). The use of the retarded Green's function method allows the approximate calculation of terms which cannot be ignored near the Curie temperature. It is found that the ferromagnetic electrons change both the frequency and intensity of NMR. In addition, at room temperatures the influence of the variable external field on the nucleus is more effective through the hyperfine interaction than

ACCESSION NR: AP4019857

directly. At high temperatures the reverse is true. Orig. art. has: 42 equations.

ASSOCIATION: Institut kibernetiki AN GrSSR Tbilisi (Institute of Cybernetics AN GrSSR)

SUBMITTED: 05Aug63 DATE ACQ: 31Mar64 ENCL: 00

SUB CODE: PH NO REF SOV: 004 OTHER: 002

Card 2/2

BUISHVILI, L.L.

Forbidden nuclear paramagnetic resonance in ferromagnetic substances. Fiz. tver. tela 5 no.11:3291-3293 N '63. (MIRA 16:12)

1. Institut kibernetiki AN GruzSSR, Tbilisi.

BUISHVILI, L.L.

Nuclear magnetic resonance in deformed ferromagnetics. Fiz. tver. tela 5 no.11:3327-3328 N '63. (MIRA 16:12)

1. Institut kibernetiki AN Gruzinskoy SSR, Tbilisi.

BUISHVILI, L.L.

Polarization of nuclei by hot electrons. Fiz. tver. tela 6 no.1: 108-112 Ja '64. (MIRA 17:2)

1. Institut kibernetiki AN Gruzinskoy SSR, Tbilisi.

BUISHVILI, L.L.

Theory of nuclear magnetic resonance in ferromagnetic dielectrics.
Fiz. tver. tela 6 no.3:903-905 Mr '64. (MIRA 17:4)

1. Institut kibernetiki AN Gruzinskoy SSR, Tbilisi.

ACCESSION NR: AP4039643 S/0181/64/006/006/1619/1621

AUTHOR: Buishvili, L. L.

TITLE: Nuclear acoustical paramagnetic resonance in antiferromagnetic materials

SOURCE: Fizika tverdogo tela, v. 6, no. 6, 1964, 1619-1621

TOPIC TAGS: acoustical absorption, antiferromagnetic material, nuclear paramagnetic resonance, spin wave, spin wave magnetostriction, ultrasound

ABSTRACT: The excitation by ultrasound of ordinary spin waves and so-called wall waves in antiferromagnetics is considered. The wall waves can be excited by ultrasound considering magnetostriction. The Hamiltonian of the system can be written in the form

$$H=\int dV\left\{{}^1/_2\alpha\left[(\nabla M_1)^2+(\nabla M_2)^2\right]+\alpha_{12}\nabla M_1\nabla M_2+\delta(\vec{M}_1\vec{M}_2)+\right.$$

$$\left.+\frac{\beta_1}{2}(M_{1y}^2+M_{2y}^2+M_{1z}^2+M_{2z}^2)+H_{m.st.}\right\},$$

where the first three terms correspond to the exchange interaction, the fourth is

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ACCESSION NR: AP4039643

the anisotropy energy, $M_{1,2}$ is the magnetic moment per unit volume of the first and second sublattice respectively, and $H_{m.str.}$ =

$$\delta_1 (M_{1i}M_{1k} + M_{2i}M_{2k}) u_{ik} + \delta_2 (M_{1i}M_{2k} + M_{1k}M_{2i}) u_{ik} +$$
$$+ \delta_{ik} [\delta_3 (M_1 M_2) + \delta_4 (M_1^2 + M_2^2)] u_{ik}.$$

For simplicity the 180° Bloch wall is considered. The equations of motion for ($f = M_1 + M_2$) are found in the wall coordinate system (X,Y,z). If the ultrasound is of the form

$$\vec{u} = u_z^0 e^{i(\omega t - k_z z)},$$

then

$$f_Y = A e^{i(\omega t - k_z z)} \cos \vartheta, \quad f_z = B e^{i(\omega t - k_z z)} \cos \vartheta,$$

where

$$|A|^2 = \frac{[2k_z \gamma M_0^2 (\delta_1 - \delta_2)]^2 (\omega^2 + \Gamma^2)}{(\omega^2 - \omega_1^2)^2 + 4\omega^2 \Gamma^2} |u_z^0|^2;$$

$$\left|\frac{A}{B}\right|^2 = \frac{\omega^2 + \Gamma^2}{[\gamma M_0 \beta_1]^2}; \quad \omega_1 = \gamma M_0 \sqrt{2\delta\beta_1}.$$

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ACCESSION NR: AP4039643

and θ is the angle between the anisotropy axis and the direction of magnetization in the wall. Since $\theta = 1$ outside the wall, these waves are not attenuated there and hence correspond to ordinary spin waves. If

$$u = u_z^0 e^{i(\omega t - k_y y)},$$

then

$$f_r = A e^{i(\omega t - k_y y)} \sin \vartheta; \quad f_\theta = B e^{i(\omega t - k_y y)} \sin \vartheta.$$

The expressions for A and B have the same form as in the previous case except that k_x and β_1 are replaced by k_y and β_2 respectively. Since $\sin \theta = 0$ outside the walls, these waves are attenuated there and correspond to the wall waves. The coefficient of ultrasound absorption by the nuclei is given by

$$\sigma_{1,2} = \alpha_{1,2} \frac{a^2 T_2 \omega_n^2 \gamma^2 M_0^4 (\delta_1 - \delta_2)^2 [\omega_n^2 + \Gamma^2 + (\gamma M_0 \beta_{1,2})^2]}{2kTMc^3 h^4 \omega_{1,2}^4},$$

where the index 1,2 corresponds to absorptions due to excitation of ordinary and wall vibrations, α is the relative number of nuclei absorbing the ultrasound,

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ACCESSION NR: AP4039643

T_2 is the nuclear resonance width, M is the nuclear mass, c is the sound velocity and

$$\overline{\omega_z} = \gamma M_0 \sqrt{2\delta\beta_z}.$$

Orig. art. has: 7 equations.

ASSOCIATION: Institut kibernetiki AN GruzSSR, Tbilisi (Institute of Cybernetics AN GruzSSR)

SUBMITTED: 20Nov63 DATE ACQ: 19Jun64 ENCL: 00

SUB CODE: GP, MT NO REF SOV: 004 OTHER: 004

Card 4/4

ACCESSION NR: AP4043335 S/0181/64/006/008/2238/2244

AUTHORS: Buishvili, L. L.; Giorgadze, N. P.; Gurgenishvili, G. E.

TITLE: Influence of skin effect on nuclear magnetic resonance in ferromagnets

SOURCE: Fizika tverdogo tela, v. 6, no. 8, 1964, 2238-2244

TOPIC TAGS: ferromagnet, nuclear magnetic resonance, skin effect, nuclear spin

ABSTRACT: Nuclear magnetic resonance in ferromagnetic specimens whose dimensions exceed the depth of the skin layer ($\sim 10^{-5}$ cm and above) are considered. This effect is of interest because in the case of NMR in ferromagnets the radio-frequency field acts on the system of nuclear spins not only directly, but also indirectly via the spins of the magnetic electrons, thus considerably intensifying the effective rf field and increasing the absorption. Another

ACCESSION NR: AP4043335

effect is the correlation between the nuclear spins and the indirect Suhl-Nakamura interaction (H. Suhl, Phys. Rev. v. 109, 606, 1958; T. Nakamura, Progr. Theor. Phys. v. 20, 542, 1958), which causes a shift in the NMR frequency. The analysis is made for the magnetic field both parallel and perpendicular to the surface of the sample, and it is assumed for simplicity that the ferromagnet is magnetized to saturation by the external magnetic field. An expression is derived for the equivalent permeability, which determines the absorbed power. It is shown that the skin effect gives rise to an additional shift in the resonant frequency. The perturbations introduced by the skin effect are estimated to be approximately one-tenth those connected with the Suhl-Nakamura interaction, and it is therefore estimated that they become observable at temperatures below 0.3K. Orig. art. has: 28 formulas.

ASSOCIATION: Institut kibernetiki AN Gruz.SSR (Institute of Cybernetics, AN GruzSSR); Institut fiziki AN Gruz.SSR, Tbilisi

ACCESSION NR: AP4043335

(Institute of Physics, AN GruzSSR)

SUBMITTED: 18Nov63

ENCL: 00

SUB CODE: SS, NP

NR REF SOV: 001

OTHER: 005

Card 3/3

BUISHVILI, L.L.

Nuclear acoustic paramagnetic resonance in antiferromagnetics.
Fiz. tver. tela 6 no.6:1619-1621 Je '64. (MIRA 17:9)

1. Institut kibernetiki AN Gruzinskoy SSR, Tbilisi.

BUISHVILI, L.L.; GIORGADZE, N.P.

Dependence of nuclear magnetic resonance on the skin effect in the domain wall of a ferromagnetic. Fiz. tver. tela 6 no. 9:2846-2847 S '64.

(MIRA 17:11)

1. Institut kibernetiki AN Gruzinskoy SSR i Institut fiziki AN GruzSSR, Tbilisi.

L 6825-65 EWT(1)/EPA(s)-2 Pt-10 IJP(c)/AS(mp)-2/RAEM(c)/SSD/AFWL/
RAEM(i)/ESD(t)/RAEM(t) GG
ACCESSION NR: AP4044961 S/0181/64/006/009/2846/2847

AUTHORS: Buishvili, L. L.; Giorgadze, N. P. 61 59

TITLE: Influence of skin effect on nuclear magnetic resonance in the domain wall of a ferromagnet

SOURCE: Fizika tverdogo tela, v. 6, no. 9, 1964, 2846-2847

TOPIC TAGS: skin effect, nuclear magnetic resonance, domain structure, ferromagnet

ABSTRACT: The influence of the skin effect is estimated by a simple analysis of a ferromagnetic plate of thickness equal to a single ferromagnetic domain, with 180° orientation between domains and with longitudinal dimensions assumed small compared with the thickness of the plate. Assuming that the surface energy of the transition layer is larger than that of the magnetization layer, so that an external radio frequency field displaces the domain boundary as a whole, it

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L 6825-65

ACCESSION NR: AP4044961

2

is shown that the alternating field penetrates into the domain by a small amount, and the skin effect exerts a noticeable influence on the absorption of energy. This is manifest in a decrease in the amplitude of the oscillation of the boundary and accordingly in a decrease of the nuclear magnetic resonance gain in the ferromagnet. Orig. art. has: 5 figures.

ASSOCIATION: Institut kibernetiki AN GruzSSR (Institute of Cybernetics AN GruzSSR); Institut fiziki AN GruzSSR, Tbilisi (Institute of Physics, AN GruzSSR)

SUBMITTED: 18Nov63

ENCL: 00

SUB CODE: NP, EM

NR REF SOV: 001

OTHER: 001

Card 2/2

L 12931-65 EWT(l)/EPA(s)-2 Pt-10 IJP(c) GG ASD(a)-5/AFWL/SSD/
AS(mp)-2/RAEM(c)/RAEM(a)/ESD(gs)/ESD(t)
ACCESSION NR: AP4046598 S/0181/64/006/010/2921/2925

AUTHORS: Buishvili, L. L.; Giorgadze, N. P.; Kharadze, G. A.

TITLE: Magnetic resonance in antiferromagnets with helical structure

SOURCE: Fizika tverdogo tela, v. 6, no. 10, 1964, 2921-2925

TOPIC TAGS: antiferromagnetism, magnetic resonance, electron spin, nuclear spin, magnetic susceptibility, magnetic structure

ABSTRACT: The article is devoted to a theoretical investigation of resonance phenomena in magnetic substances having a helical structure, with allowance for the hyperfine interaction between the electron and nuclear spins. The components of the tensor of the high-frequency susceptibility of the spin system are calculated. The calculation is in an approximation that is linear in the external alternating field. It is shown that in the longitudinal case, i.e., when the magnetic vector of the high frequency field is parallel to

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L 12931-65
ACCESSION NR: AP4046598

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the axis of the helix, resonance absorption can be observed due to the presence of a gap in the spectrum of the elementary excitations of the bound electron-nuclear spin system (hyperfine interaction effect). If the magnetic vector of the alternating field is perpendicular to the helix axis, the resonant absorption is connected with the formation of elementary excitations with a wave vector parallel or antiparallel to the helix axis. If the magnetic vector is directed parallel to the axis, the resonance corresponds to excitation with zero wave vector. Orig. art. has: 25 formulas.

ASSOCIATION: Institut kibernetiki AN GruzSSR (Institute of Cybernetics AN GruzSSR); Institut fiziki AN GruzSSR, Tbilisi, (Institute of Physics, AN GruzSSR)

SUBMITTED: 06Mar64

ENCL: 00

SUB CODE: SS, NP

NR REF SOV: 003

OTHER: 005

Card 2/2

L 11987-65 EWG(j)/EWT(m)/EPF(c)/EPF(n)-2/EWP(j)/T/EWA(h)/EWA(l) Pc-4/Pr-4/
Peb/Pu-4 SSD/BSD/AS(mp)-2/AFWL/ESD(t) GG/RM

ACCESSION NR: AP4046612 S/0181/64/006/010/3016/3019

AUTHORS: Buishvili, L. L.; Kessenikh, A. V.

TITLE: Spin diffusion and nuclear relaxation in irradiated polymers

SOURCE: Fizika tverdogo tela, v. 6, no. 10, 1964, 3016-3019

TOPIC TAGS: spin diffusion, nuclear spin, relaxation time, paramagnetic center, polymer chain, polyethylene, irradiation

ABSTRACT: The case is considered when the nuclear spin diffusion time is shorter than the time of direct relaxation of the nuclei closest to the local paramagnetic center. In such a case it is possible to introduce a single nuclear spin temperature and consequently assume an equal value for the nuclear polarization at each point, not necessarily equal to the equilibrium value. In this case, starting from the relaxation equation at an arbitrary point, simple

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L 11987-65
ACCESSION NR: AP4046612

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calculations lead to the same results as the standard solution for the nuclear spin diffusion equation. A comparison of the theoretical calculation for a local paramagnetic center delocalized along a linear polymer chain (such as polyethylene) lead to satisfactory agreement. "The authors thank G. R. Khutsishvili for discussions and M. P. Giorgadze for valuable remarks." Orig. art. has: 10 formulas.

ASSOCIATION: Fiziko-khimicheskiy institut M. Karpova, Moscow (Physicochemical Institute)

SUBMITTED: 06Apr64

ENCL: 00

SUB CODE: NP, OC

NR REF SOV: 008

OTHER: 004

L 43942-65 EWT(m) . Peb DIAAP

ACCESSION NR: AP5006873 S/0181/65/007/003/0722/0729

AUTHOR: Buishvili, L. L.; Zubarev, D. N. 16

TITLE: Statistical theory of nuclear spin diffusion 19 12 6

SOURCE: Fizika tverdogo tela, v. 7, no. 3, 1965, 722-729

TOPIC TAGS: nuclear spin diffusion, irreversible thermodynamics, diamagnetic substance, correlation function

ABSTRACT: The spin diffusion of solid diamagnetic substances is analyzed from the point of view of the statistical mechanics of irreversible processes, using the method of statistical operator for a non-equilibrium system, developed by one of the authors (Zubarev, DAN SSSR v. 140, 92, 1961). Linear relations are obtained between the thermodynamic forces and fluxes on the one hand and the quantum statistical expressions for the kinetic coefficients on the other. Concrete expressions for the kinetic coefficients are obtained by making certain simplifying assumptions. The Bloembergen diffusion equation (Physica v. 15, 386, 1949) is derived, with coefficients that are expressed in explicit form in terms of the de-

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L 43942-65

ACCESSION NR: AP5006873

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termined correlation functions. "L. L. Buishvili is grateful to Professor G. R. Khutsishvili for a discussion of the results." Orig. art. has: 27 formulas.

ASSOCIATION: Institut kibernetiki AN GruzSSR, Tbilisi (Institute of Cybernetics, AN GruzSSR); Matematicheskiy institut im. V. A. Stekova (Institute of Mathematics)

SUBMITTED: 28Jul64 ENCL: 00 SUB CODE: NP, SS

NR REF SOV: 006 OTHER: 005

Card 2/2 MB

L 49033-65 EWT(1)/EPA(s)-2 Pt-7 IJP(c) GG

ACCESSION NR: AP5006879 S/0181/65/007/003/0769/0774

3/ 29. B

AUTHOR: Buishvili, L. L.; Giorgadze, N. P.

TITLE: Nuclear acoustic resonance in ferromagnets and antiferromagnets 21

SOURCE: Fizika tverdogo tela, v. 7, no. 3, 1965, 769-774

TOPIC TAGS: ferromagnetism, antiferromagnetism, nuclear acoustic resonance, magnetostriction, acoustic energy absorption

ABSTRACT: This is a continuation of a previous study of nuclear acoustic resonance (NAR) in magnets (FTT v. 4, 1367, 1962; v. 5, 1027, 1963), and is devoted to NAR on nuclei of both magnetic and nonmagnetic atoms in ferromagnets and antiferromagnets. The absorption of sound by both types of atoms is evaluated by the Green's function method. The two mechanisms causing sound absorption in NAR (magnetostriction or modulation of the magnetic interaction) are analyzed and it is shown that magnetostriction absorption predominates in cubic crystals and modulation of the magnetic interaction is stronger in hexagonal crystals. Magnetostriction absorption has the same magnitude in ferromagnets and antiferromagnets. Orig. art. has: 21 formulas.

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L 49033-65
ACCESSION NR: AP5006879 2

ASSOCIATION: Institut kibernetiki AN GruzSSR (Cybernetics Institute, AN GruzSSR); Institut Fiziki AN GruzSSR, Tbilisi (Physics Institute, AN GruzSSR)

SUBMITTED: 15Aug64 ENCL: 00 SUB CODE: EM, NP

NR REF SOV: 004 OTHER: 005

Card 2/2

BUISHVILI, L.L.; GIORGADZE, N.P.; KHARADZE, G.A.

Acoustic resonance in magnets of simple helicoidal structure.
Fiz. tver. tela 7 no. 12:3662-3664 D '65 (MIRA 19:1)

1. Institut fiziki AN GruzSSR, Tbilisi.

BUISHVILI, L.L.

Quantum statistical theory of dynamic polarization of nuclei. Zhur.eksp. i teor.fiz. 49 no.6:1868-1874 D '65. (MIRA 19:1)

1. Institut kibernetiki AN GruzSSR. Submitted July 1, 1965.

BUITVYDAS, Pranas; ALEKSIUNAITE, A., red.

[The artery of life; sketches] Gyvybes arterija; apybraizos. Vilnius, Leidykla "Mintis," 1964. 56 p.

(MIRA 18:1)

BUIU, I.

BUIU, I. Aircraft modeling. p. 21.

Vol. 2, No. 10, October 1956
ARIPILE PATRIEI
TECHNOLOGY
Bucuresti

So: East European Accession, Vol. 6, No. 3, March 1957

BUIUKLE, B.

BRATANOV, Br., dotsent; BUCHVAROVA, V.; BUIUKLIE, B.; LOLOVA, M.

Pseudocavernous pneumonia in children. Nauch.tr.ISUL, Sofia 2 no.2: 51-65 1953.

1. Klinika po detski bolesti. Zav. katedrata: dots. Br.Ts.Bratanov.
(PNEUMONIA, in infant and child, pseudocavernous)

Radioactive characteristics of the Zechstein salt series in Kujawy. Kazimierz Przewłocki, Zdzisław Buła, Leopoled Jurkiewicz, and Józef Poborski (Acad. Mining, Kraków). Acta Geophys. Polon. 4, 5-20(1956)(in English).—The β-radiation of the salt beds at Inowrocław has been detd. by means of Geiger-Mueller counters. The increased radioactivity is assocd. with local intercalations of K salts. An explanation of the origin of sylvinite veins is proposed.

I. Stecki

4

Geo

RMK

BUJA, Z.

Distr: 4E3d

3078

CONSTRUCTION OF METALLIC GEIGER-MUELLER COUNTERS. Z. Buja, A. Oleś, and K. Ostrowski. (Mining-Metallurgical Acad., Warsaw.) Nukleonika 2, No. 2, 321-34(1957). (In Polish)

The design and performance of metallic Geiger-Mueller tubes are described. Operations of Geiger-Mueller counters for γ and β rays in laboratory research, the temperature dependence of the counters, and the performance characteristics are discussed. (R.V.J.)

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pmh

BUJA, Z.

5

P/046/62/007/002/001/003
D256/D302

9,6150 (also 1482)

AUTHORS: Grigorov, N.L., Tretyakova, Ch.A., Shestoperov, V.J., Babyan, Kh.P., Bayadzhyan, N.G., Buja, Z., Loskiewicz, J., Massalski, J., and Oleś, A.

TITLE: Integral spectrum of ionization pulses caused by nuclear active particles of cosmic radiation at mountain altitudes

PERIODICAL: Nukleonika, v. 7, no. 2, 1962, 61 - 73

TEXT: The investigation was conducted in order to obtain information concerning: 1) The pulse spectrum and its dependence upon the dimensions of the apparatus, 2) the altitude dependence of the frequency of the registered pulses, 3) the mechanism of local generation of π^0 mesons by nuclear active particles. The apparatus covered an area of 10 m^2 and it consisted of 6 horizontal trays of 33 ionization chambers each, the trays being separated by graphite and lead absorbers, arranged to enable detection of electromagnetic cascades created by the decay products of π^0 mesons and evaluation X

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Integral spectrum of ionization ... P/046/62/007/002/001/003
D256/D302

of the energy transferred in the interactions up to 2×10^{13} ev. The pulses and pulse heights were recorded photographically from screens of 6 cathode-ray oscilloscopes with waiting spot. Using mechanical selectors it was possible to register subsequently individual pulses from all the ionization chambers, each of them being connected to its own amplifier. The experiments were carried out at two altitudes: 200 m (Moscow) and 3200 m above the sea level (the Mountain Station of the Armenian Academy of Sciences at Mount Aragac). Owing to the independent registration in each ionization chamber it was possible to divide the registered pulses into two groups: 1) Single pulses, i.e. events in which the pulse in each tray was registered by a small number of ionization chambers; 2) Structural' pulses defined as events occuring at least in one of the trays 1 to 4, in such a way that the groups of ionization chambers showing pulses were interspaced with one or more chambers without any ionization. The first group of pulses was attributed to nuclear active particles as well as μ mesons, and the second one could be produced only by groups of nuclear active particles falling simultaneously on the apparatus, as it was borne out from the X

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investigation of the influence of the dimensions of the apparatus used upon the ionization spectra. The dependence of the percentage of the structural pulses upon the registered pulse height was examined, showing that the percentage of the structural pulses is a monotonic function increasing with the increase of the total pulse height registered i.e. with increasing the total energy. In order to assess the role of μ mesons, the altitude dependence was investigated of generating pulses of different nature. The integral spectra were found to be exponential: $N = AI^{-\gamma}$ in the region of pulse heights from 10^3 to 10^5 particles. The following conclusions were derived from the analysis of the experimental results: 1) The spectra induced by nuclear active particles depend essentially on the dimensions of the apparatus and on the pulse heights. The exponent γ of the integral spectrum for pulse heights (measured in numbers of particles) ranging from 2×10^3 to 2×10^5 particles changes from $\gamma = 1.41$ to $\gamma = 2.00$ for the area of the apparatus changing from 330×330 cm^2 to 10×330 cm^2 respectively. 2) At mountain altitudes the exponent γ of the integral spectrum for single nuclear active particles was determined to be $\gamma = 2.01 \pm 0.08$ for $3 \times$

$10^3 \leq I \leq 3 \times 10^4$, and for all the nuclear active particles including the structural pulses $\gamma = 1.62 \pm 0.04$. 3) The integral spectrum of the large pulses by μ mesons is also of an exponential form with $\gamma = 2.22 \pm 0.14$. 4) At the sea level the contribution of the μ mesons constitutes approx. 70 % of all single pulses with a height $\geqslant 2 \times 10^3$ particles and 50 % for heights $\geqslant 2 \times 10^4$ particles. There are 5 figures, 4 tables and 4 Soviet-bloc references. X

ASSOCIATION: Institute of Nuclear Physics, University of Moscow; (N.L. Grigorov, Ch.A. Tretyakova, and V.J. Shestoperov); Institute of Nuclear Physics, Armenian Academy of Sciences, Yerevan; (Kh.P. Babayan, and N.G. Bayadzhyan); Institute of Nuclear Research, Polish Academy of Sciences, Cracow; Academy of Mining and Metallurgy, Cracow, II Department of Physics (Z. Buja, J. Łoskiewicz, J. Massalski, and A. Oleś)

SUBMITTED: January, 1962

Card 4/4

GRIGOROV, N.L.; TRETYAKOVA, C.A.; SHESTOPIEROV, V.J.; BABAYAN, C.P.; BAYADSYAN, N.G.; BUJA, Z.; LOSKIEWICZ, J.; MASSALSKI, J.; OLES, A.

Integral spectrum of ionization pulses caused by nuclear active particles of cosmic radiation at mountain altitudes. Nukleonika 7 no.2:61-73 '62.

1. Institute of Nuclear Physics, University of Moscow (for Grigorov, Tretyakova and Shestopierov). 2. Institute of Nuclear Physics, Armenian Academy of Sciences, Erevan (for Babayan and Bayadsyan). 3. Institute of Nuclear Research, Polish Academy of Sciences, Cracow and Department of Physics II, Academy of Mining and Metallurgy, Cracow (for Buja, Loskiewicz, Massalski and Oles.)

BABECKI, J.; BUJA, Z.; MASSALSKI, J.; NIZIOL, B.

Energy spectrum of photons from decay of π^0-mesons generated in nuclear interactions at the altitude of 3200 m. above sea level. Acta physica Pol 24 no.3:373-380 S'63.

1. Institute of Nuclear Research, Laboratory of High Energy Physics, Krakow Department.

BUJA, Z.

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Uncl.

L 05215-67 EWP(e) WH/WW

ACC NR: AP6026996 SOURCE CODE: PO/0045/66/029/005/0643/0653 76 75 B

AUTHOR: Bujok, Jozef

ORG: Main Institute of Mining, Katowice (Glowny Instytut Gornictwa)

TITLE: Further results from research on stress-induced variations in the spectral distribution of gamma radiation from Cs^{137} transmitted by graphitized carbon 14 15

SOURCE: Acta physica polonica, v. 29, no. 5, 1966, 643-653

TOPIC TAGS: graphitization, carbon, gamma radiation, spectral distribution, CESIUM, RADIOISOTOPE

ABSTRACT: Experimental data are given on variations in the spectral distribution of gamma rays (Cs^{137}) emitted by bulk carbon under compressive stresses. The experimental set-up is shown in the figure where the Roman numerals indicate radiation detector positions. Measurements were made at each of these positions after application of a given force and the load was then increased and the measurements of amplitude distribution were repeated for each position. The experimental conditions and the material used are described in previous studies by the author in cooperation with B. Sujak. The results confirm the conclusions previously reached by the author (Bujok, J., Sujak, B., *Acta Phys. Polon.*, 27, 671, 1965), i. e. that there is a relationship between the stressed state of graphitized carbon and its interaction with

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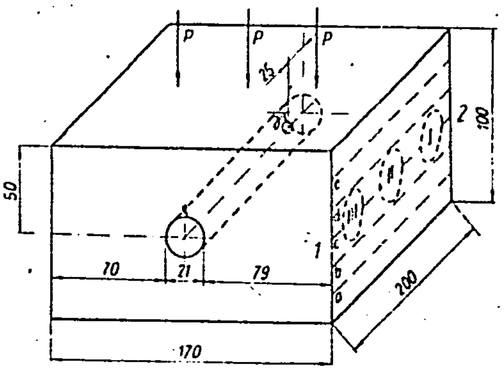
ACC NR: AP6026996

gamma quanta. A comparison of the data with those obtained in the previous work indicates that the variations observed in scattering are due to differences in the spectral distribution of the scattered radiation induced by variations in stress. I wish to thank Doctor B. Sujak who assisted in my understanding of the problem by invaluable consultation, remarks and discussion. Orig. art. has: 10 figures.



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Micrococcus, in steomyelitis)
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